5 Future Directions: Conservation of Seasonal Pools in the Mid-Atlantic Region

5.1: Seasonal Pool Conservation in the Mid-Atlantic Region

As yet, there are few comprehensive efforts to include seasonal pools in natural resources management in most of the mid-Atlantic States. The New Jersey Division of Wildlife Endangered and Nongame Species Program initiated a Vernal Pool Survey Project in 2000, a statewide seasonal pool mapping program. This project's goal is to locate, map, and inventory seasonal pools statewide and monitor their amphibian populations utilizing a trained group of volunteers (Tesauro, 2004). A similar project, the development of a web-based seasonal pool registry and research program, is being prepared for implementation in Pennsylvania by the Western Pennsylvania Conservancy (see Appendix C).

In the other mid-Atlantic states, there have been smaller-scale initiatives undertaken by governmental agencies, nongovernmental organizations, and coalitions. For example, the ARMI-NE of the USGS and partners (U.S. Fish and Wildlife Service and National Park Service) have located, mapped, and surveyed amphibian populations at seasonal forest pools in nine National Parks and National Wildlife Refuges in the mid-Atlantic states (see Appendix C).

Unique systems of seasonal pools in the mid-Atlantic region, such as sinkhole ponds in Virginia and Delmarva bays in Delaware-Maryland, have received attention by naturalists, academics, and agency scientists (e.g., Rawinski, 1997; Roble, 1998; Buhlmann et al., 1999; Zankel and Olivero, 1999). However, there is a considerable need for additional research on seasonal pools. Moreover, existing studies have largely not been translated into conservation or management programs.

Seasonal pools should be valued and managed as important ecosystems for support of biodiversity in the mid-Atlantic region. In recent years, concern over amphibian conservation has escalated due to reports of declines in amphibian populations on a global-scale (Barinaga, 1990; Stuart et al., 2004). Existing amphibian monitoring efforts, such as the National Wildlife Federation's FrogWatch and the USGS North American Amphibian Monitoring Program, provide data on frog and toad populations but do not address the major cause of amphibian declines: the loss of habitat including seasonal pools. There is a need to bring a broader, landscape perspective to the conservation of amphibians in the mid-Atlantic region. There must be adequate protection and management of habitat, which for seasonal pool-breeding amphibians includes the seasonal pool basin and the surrounding terrestrial area that extends 1000 ft (305 m) or farther from the edge of the pool. Characteristics of the landscape up to 3281 ft (1000 m) from the pool edge, such as amount of forest cover or densities of roads, may also strongly influence the presence and densities of amphibian species (Homan et al., 2004; Porej et al., 2004; Herrmann et al., 2005). For successful management of the seasonal pool ecosystem, the seasonal pool itself should not be considered separate from the terrestrial habitat.

The authors recommend that a three-pronged approach be taken for conservation of seasonal pools in the mid-Atlantic region. Simultaneous efforts should be taken in the following areas: education and research, seasonal pool inventory, and landscape-level management. There needs to be a targeted campaign to raise the level of awareness and knowledge about seasonal pools, the reliance of amphibians upon seasonal pools, and the threats that face them. The audience of this campaign should be broad, and include professionals as well as the general public. It is also important to escalate seasonal pool research efforts in the mid-Atlantic region. Second, there needs to be a region-wide initiative to locate and inventory seasonal pools in order to determine their abundance, distribution, and biological resources. Lastly, seasonal pools and their associated life zones should be integrated into landscape-level planning by local, county, and state agencies and nongovernmental organizations. Pools should be prioritized for conservation considering several factors: the degree to which amphibians and invertebrates depend upon them, the condition of the terrestrial life zone, and the proximity to and density of seasonal pools in the landscape (e.g., pool clusters).

5.2: Education and Research on Seasonal Pools

In order to facilitate successful seasonal pool conservation efforts, stakeholders must be identified, information must be disseminated, and the issue has to be publicized. In addition, basic research on seasonal pools in the mid-Atlantic region is needed so as to inform efficacious management strategies.

☑ **Establish a Scientific and Management Dialogue.** Regardless of whether there have been local or state efforts at seasonal pool inventory or conservation, there are individuals in each mid-Atlantic state who are working with seasonal pool-related issues. For example, there are nongovernmental organizations working on amphibian conservation research and policy, academics and governmental agencies studying amphibian populations, and naturalists hosting educational programs in local parks. These interested individuals should be brought together. Workshops can be held on locating seasonal pools using various tools such as aerial photography and field verification, or a mid-Atlantic seasonal pools conference can be convened with the participation of experts from states that have seasonal pool programs in place, such as New Jersey, Maine, and Massachusetts.

☑ **Increase Public Awareness.** The level of public awareness is very low. Amphibians, such as spotted salamanders and wood frogs, will likely be of greatest interest to the general citizenry. The connection between seasonal pools and these charismatic amphibians must be made. The target audience should be broad and include homeowners, school children, and volunteers.

☑ **Raise Level of Knowledge.** Many of the studies on seasonal pools referred to in this publication were carried out in areas other than the mid-Atlantic region, particularly in Maine, Massachusetts, and South Carolina. More studies on the natural history, ecology, hydrology, vegetation, and conservation biology of seasonal pool ecosystems are needed in the mid-Atlantic region. Research partnerships should be explored between academic institutions and governmental agencies.

5.3: Inventory of Seasonal Pools

An important requirement for sustainable management of a resource is an inventory of its distribution and status. Currently, the number of seasonal pools, their distribution in the landscape, and their biological resources are unknown in the mid-Atlantic region, although efforts are underway in New Jersey and are beginning in Pennsylvania.

☑ **Locate and Inventory Seasonal Pools.** Seasonal pools in the mid-Atlantic region need to be located and mapped with the data assembled electronically and in GIS format and fauna and flora must be inventoried. This may best be carried out at the county- or state-level through volunteer programs, similar to the New Jersey's Vernal Pool Survey Project. Another approach would be standardizing and housing information on seasonal pools and their fauna in a federal program, similar to the way the North American Breeding Bird Survey is administered (see *http://www.pwrc.usgs.gov/bbs*). (*For techniques to locate seasonal pools refer to Appendix A. For general information on documenting seasonal pools refer to Appendix B. For existing seasonal pool programs, including New Jersey, refer to Appendix C.*)

☑ **Monitor Seasonal Pools.** Once seasonal pools are identified, they should be monitored. The rigor and method of monitoring will differ according to the agent undertaking the monitoring and the purpose of the effort. For most seasonal pool efforts, documenting the use of the pool by indicator species (e.g., presence of spotted salamander egg masses) may be sufficient. In other cases,

more extensive population studies may be carried out. Long-term, repeated sampling of a subset of seasonal pools throughout the mid-Atlantic region is essential to catalogue the biodiversity and ecosystem health of the pools and to determine amphibian population trends. Herpetofauna that use seasonal pools may take years or longer to document and invertebrate communities may undergo rapid shifts throughout the year and between years (Mahoney et al., 1990; Pechmann et al., 1991; Gibbons et al., 1997; Simovich, 1998). Additionally, it is important to record spatial and temporal changes in seasonal pool communities and other biotic and abiotic parameters in order to understand and forecast responses of seasonal pool communities to climate change, land-use change, and other stressors.

5.4: Landscape-Level Planning and Management

Successful seasonal pool conservation can only occur when integrated into landscape-level planning. All conservation plans must take into account the three life zones described in Section 2. However, in order to adequately protect the seasonal pool biological community, seasonal pools require customized, landscape-level approaches.

☑ **Acquisition and Protection of Intact Habitats.** Although every pool may have value, nonregulatory natural resource conservation tools such as acquisition and conservation easements should initially target seasonal pools that are particularly valuable in terms of biodiversity support. Efforts should be especially directed at protection of contiguous tracts of forested terrestrial habitat containing multiple seasonal pools. Protection of clusters of pools with a range of hydroperiods will provide the best probability of long-term success in supporting indicator species (Semlitsch, 2000).

☑ **Develop Best Management Practices.** Although protection of existing pools is the highest priority for seasonal pool conservation efforts, an active management approach should also be taken to protect populations of seasonal pool-breeding animals (Semlitsch, 2000). Best management practices (BMPs) should be developed for pools with the input of scientists and resource managers. For example, management programs may include the elimination of invasive fish species, the control of sediment from development, or prescribed burns (e.g., Tyndall, 2001). Restoring or creating seasonal pools in strategic locations may also be an effective component of a management program (Biebighauser, 2000), although designing pools to have a specific hydroperiod and/or support a particular community of organisms may be difficult (Pechmann et al., 2001; Lichko and Calhoun, 2003).

☑ **Create Best Development Practices.** Best development practices (BDPs) that focus on lands surrounding seasonal pools need to be established with the participation of resource managers, state agencies, scientists, private businesses, and land developers. Recommendations should be outlined for more sustainable development and forestry practices based on the best available science. BDPs for residential and commercial development and forest habitat management guidelines to protect seasonal pools have already been developed for the northeastern United States (Calhoun and Klemens, 2002; Calhoun and deMaynadier, 2004). These publications may be a useful tool, but BDPs should also be formulated for the mid-Atlantic region. BDPs will likely be different for the mid-Atlantic region due to differences in ecology, regulatory infrastructure, and demographics as compared to New England. Also, the process of developing BDPs with the participation of all stakeholders is an important consensus-building activity that will greatly improve the chances of successful implementation (Preisser et al., 2000).

☑ **Improve Transportation Planning.** Roads can be planned and designed to reduce impacts on seasonal pools and their fauna. Road construction that destroys seasonal pools, occurs near seasonal pools, cuts through the terrestrial habitat surrounding seasonal pools, or separates pools from one another should be prevented. If roads must be built through terrestrial habitat or near seasonal pools, road overpasses can be built to allow biological and hydrological flows to remain uninterrupted. Where this is not possible, amphibian tunnels and other wildlife underpasses in conjunction with barriers can be constructed beneath roads to allow migrations (Fahrig et al., 1995; Forman and Alexander, 1998). Further research is needed to design animal tunnels/underpasses so that road mortality is reduced and landscape connectivity is restored in the most effective manner (Forman and Alexander, 1998; Dodd and Smith, 2003). If these design features cannot be installed, then road closures and assisted amphibian crossings can be organized to lower mortalities during major breeding events.

☑ **Employ Regulatory Tools.** Seasonal pools that qualify as "waters of the U.S." are under federal jurisdiction, which regulates the disposal of dredge or fill material through a permitting program (Section 404 of the Clean Water Act). For the majority of seasonal pools, which do not fall under federal protection, alternative regulatory tools may be used in order to secure greater levels of protection. State and local wetland and forest regulations may be strengthened to protect seasonal pools and their surrounding terrestrial habitat. Seasonal pools may be identified as important wildlife habitat in comprehensive land use plans (community master plans) or overlay zones may be designed by the local government and concerned stakeholders to protect seasonal pools. The resource overlay zones establish additional standards for development projects on top of the underlying zoning. These new zoning plans can be a mixture of regulations and incentives to conserve seasonal pools and their terrestrial habitats (Nolon, 1998; Calhoun and Klemens, 2002). Voluntary stewardship programs may be initiated whereby landowners conserve their pools and follow best management/development practices in adjacent forest areas and receive tax credits or annual subsidies in return (similar to the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife, see *http://northeast.fws.gov/partners*) (Tiner, 2003a).